Disk Sector and Disk Support Ring Status

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Topics

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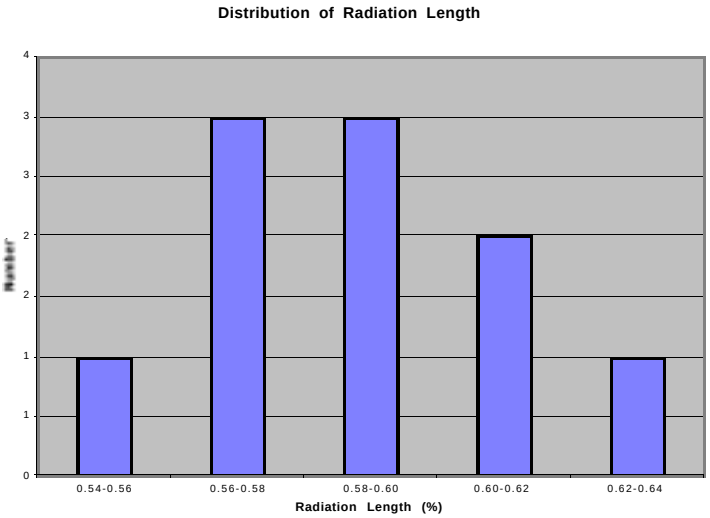
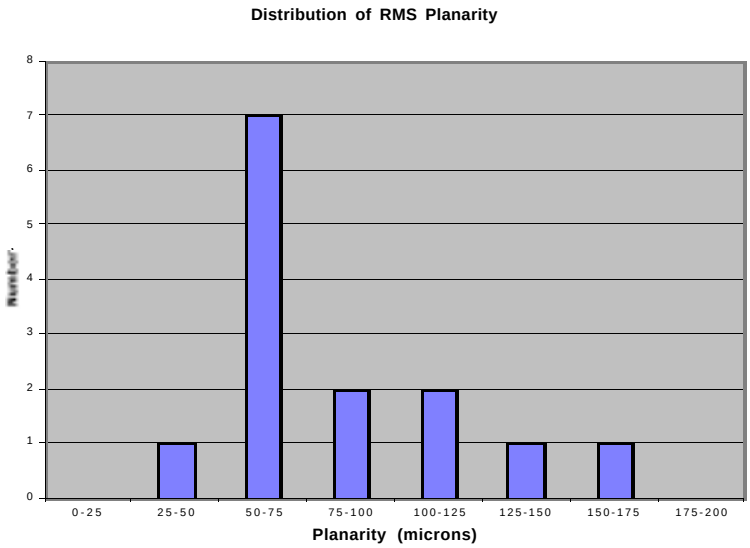
ESLI Disk Prototype Sectors

ESLI, San Diego has delivered 10 of the 12 sectors for the first prototype disk. Dummy silicon modules will be placed on the sectors which will then be assembled into a disk. The disk will be tested for distortion versus temperature and coolant pressure and thermal performance. A sector is shown below. These sectors have flattened glassy carbon tubes as on ESLI sector 9. These sectors, as were previous ESLI sectors, are all carbon.

Tube: Glassy carbon 0.25 mm wall thickness
Facings: Carbon-carbon facings 0.46 mm thick
Fill: No fill

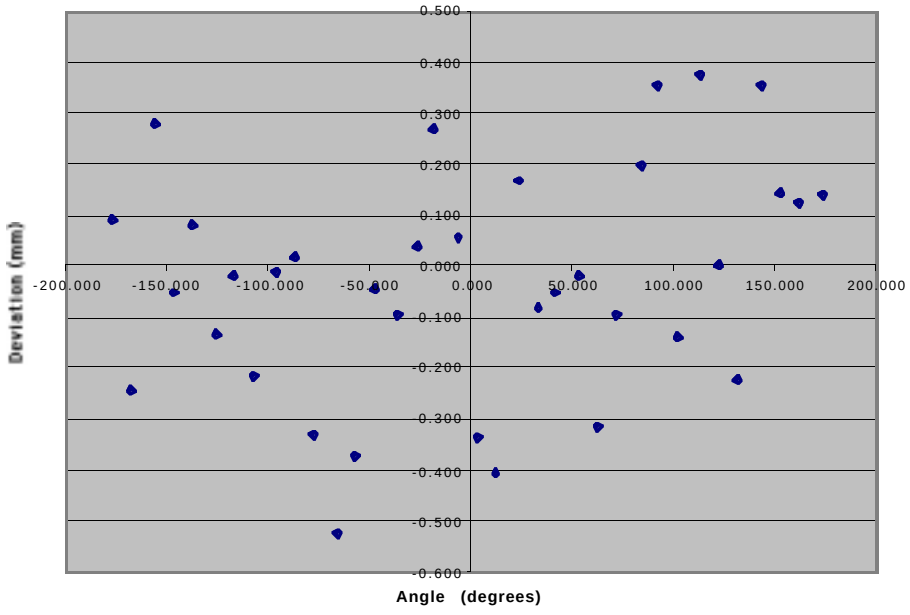
Measurements of radiation lengths and planarity are given below.





ESLI and HYTEC Prototype Disk Support Ring

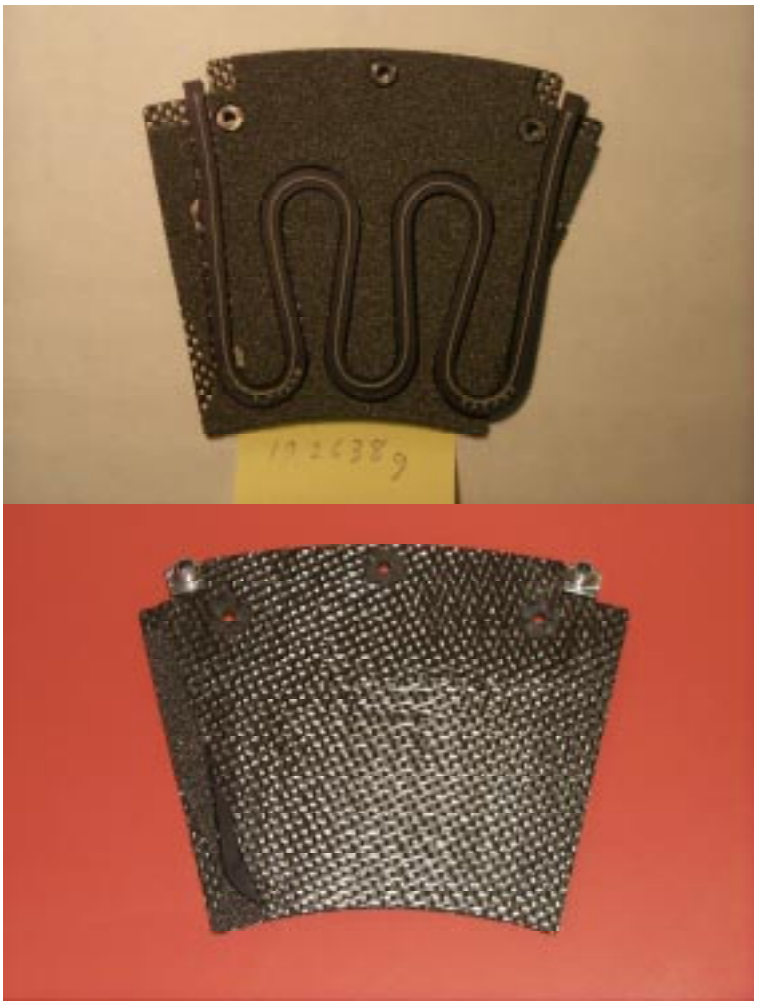
HYTEC delivered to LBNL the first prototype disk support ring. This ring is of the 12 sectors design. It is fabricated with 0.7 mm carbon-carbon facings and CFRP formed edges between the facings. The weight is 124 g giving a radiation length of 1.1%. The ring was measured using a CMM at LBNL. The mounting hole surfaces have been sanded to be planar within +/- 15 microns. Deviation of the mounting holes from their nominal radii of 195.0 mm and 204.0 mm is shown below.



Aluminum Tube Sector 5

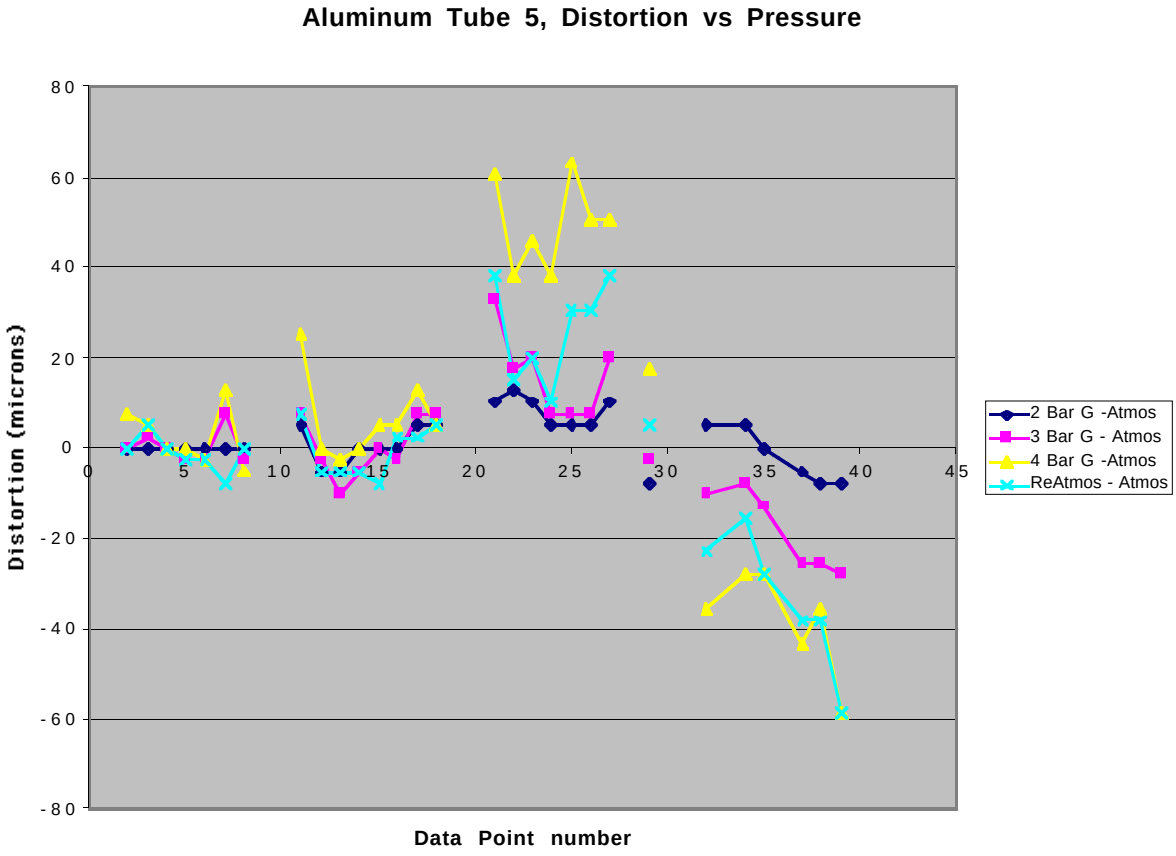
Aluminum tube sector 5 has been fabricated using a rectangular cross section aluminum tube versus the flattened round tube of aluminum tube sector 4. The aluminum tube was anodized to increase resistance to aluminum-carbon corrosion. Glass beads of 50 to 75 microns in diameter were imbedded in the CGL7018 thermal compound used between the aluminum tube and the carbon-carbon facings.

Tube:	Rectangular aluminum 0.20 mm wall thickness
Facings:	Carbon-carbon facings 0.30 mm thick
Fill:	CVD densified RVC foam and C-C hard points
Thermal Adh.	AI Technology CGL7018
Structural Adh.	Bryte Technology cyanate ester sheet
Radiation Length	0.57%



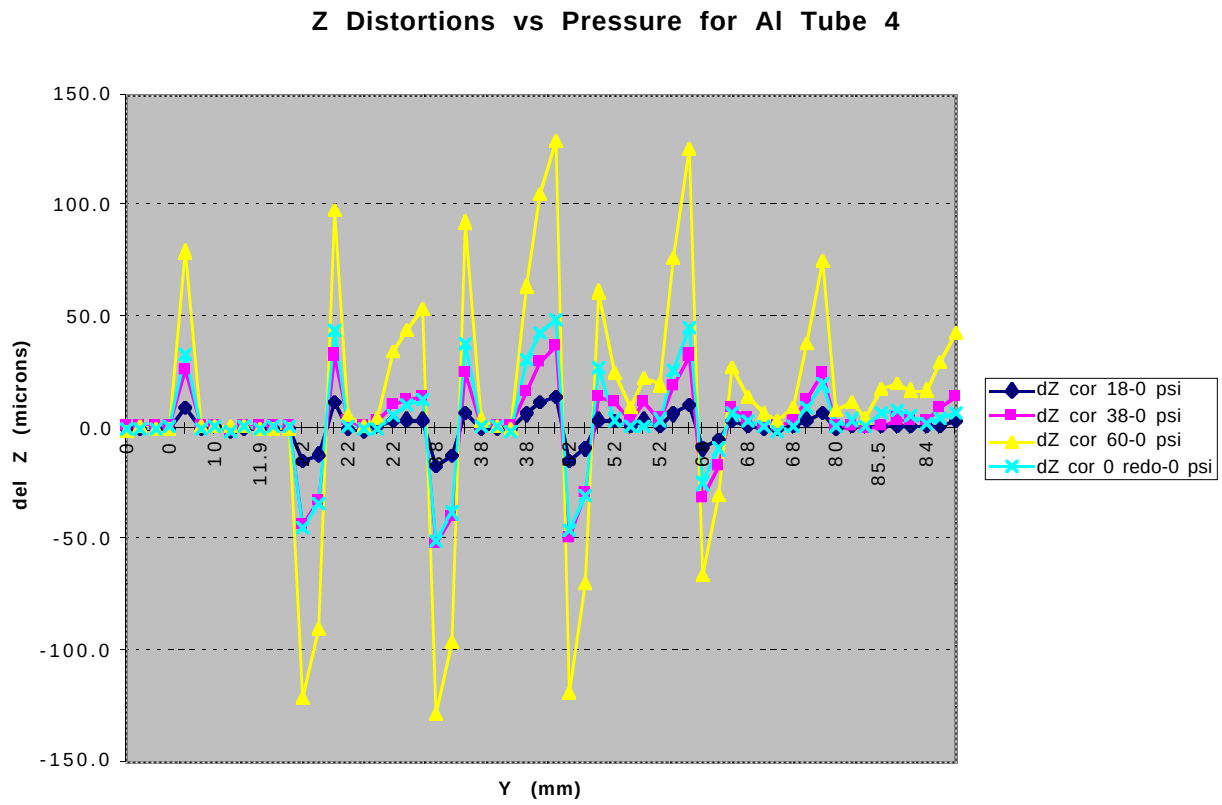
The planarity of Aluminum Tube sector 5 was measured. The rms planarity of the two sides are 20 microns and 50 microns.

Al Tube Sector 5 without dummy silicon modules: Z Distortion vs Coolant Pressure at room temperature



Distortion is plotted as a function of the radial distance from the outer radius of the sector (Data point 39 equals approximately 9 cm.). The variation of the distortion as a function transverse to the radial dimension is included but not identified. Coolant pressures were varied from 0 to 4 bar above atmospheric pressure. Maximum distortion at 3 bar above atmospheric is approximately +/- 30 microns. Maximum distortion at 4 bar is approximately +/- 60 microns with a maximum residual distortion of approximately -60 microns. This is for one side. The opposite sector side distortion was also measured and is approximately twice the distortion of the presented side. The cause of this, and probably the distortion of the presented side, is poor bonding of the second facing to the foam core.

Al Tube Sector 4 without dummy silicon modules: Z Distortion vs Coolant Pressure at room temperature



Distortion is plotted as a function of the radial distance from the outer radius of the sector. The variation of the distortion as a function transverse to the radial dimension is included but not identified. Coolant pressures were varied from 0 to 4 bar (60 psi) above atmospheric pressure. Maximum distortion is approximately 130 microns with a residual distortion of approximately 50 microns. Almost all distortion occurs on the facing overhangs.

Disk Layouts with Shingled Barrel Layouts

For the shingled barrel layout given below:

Layer 1: R = 97.0 mm, Tilt angle = 17.5 degrees
Layer 2: R = 127.0 mm, Tilt angle = 17.5 degrees
Barrel active length = 775.8 mm

A disk layout compatible with the Flex module only is:

Disk	Nr. Mods.	R inner	R outer	Z position
1	66	120.0 mm	180.8 mm	490.5 mm
2	66	120.0 mm	180.8 mm	580.0 mm
3	66	120.0 mm	180.8 mm	650.0 mm
4	54	97.0 mm	157.8 mm	710.0 mm
5	54	97.0 mm	157.8 mm	770.0 mm

This layout has acceptance gaps of approximately 0.2% and coverage to eta = +/- 2.51. This layout allows an additional 6 mm more of radial clearance between disks and support frame for services than the MCMD compatible layout.

A disk layout compatible with Flex and MCMD modules is:

Disk	Nr. Mods.	R inner	R outer	Z position
1	66	126.1 mm	186.9 mm	490.5 mm
2	66	126.1 mm	186.9 mm	580.0 mm
3	66	126.1 mm	186.9 mm	642.0 mm
4	54	103.1 mm	163.9 mm	710.0 mm
5	54	103.1 mm	163.9 mm	770.0 mm

This layout has acceptance gaps of approximately 0.3% and coverage to eta = +/- 2.45

Note: The module lengthened by 0.2 mm at each end is assumed. Total module active length = 60.8 mm.

Disk Layouts with Shingled Barrel Layouts

For the shingled barrel layout given below:

Layer 1: R = 97.0 mm, Tilt angle = 20.0 degrees
Layer 2: R = 131.5 mm, Tilt angle = 20.0 degrees
Barrel active length = 775.8 mm

A disk layout compatible with the Flex module only is:

Disk	Nr. Mods.	R inner	R outer	Z position
1	66	120.0 mm	180.8 mm	477.0 mm
2	66	120.0 mm	180.8 mm	578.0 mm
3	66	120.0 mm	180.8 mm	643.0 mm
4	54	97.0 mm	157.8 mm	708.0 mm
5	54	97.0 mm	157.8 mm	770.0 mm

For the shingled barrel layout given below:

Layer 1: R = 97.0 mm, Tilt angle = 20.0 degrees
Layer 2: R = 136.1 mm, Tilt angle = 20.0 degrees
Barrel active length = 775.8 mm

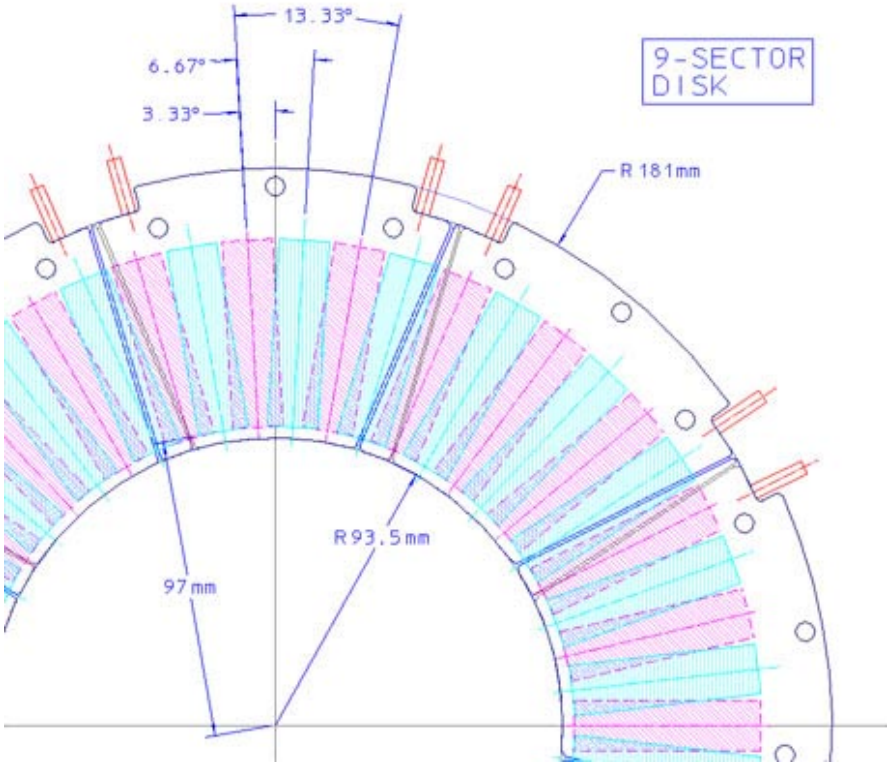
A disk layout compatible with the Flex module only is:

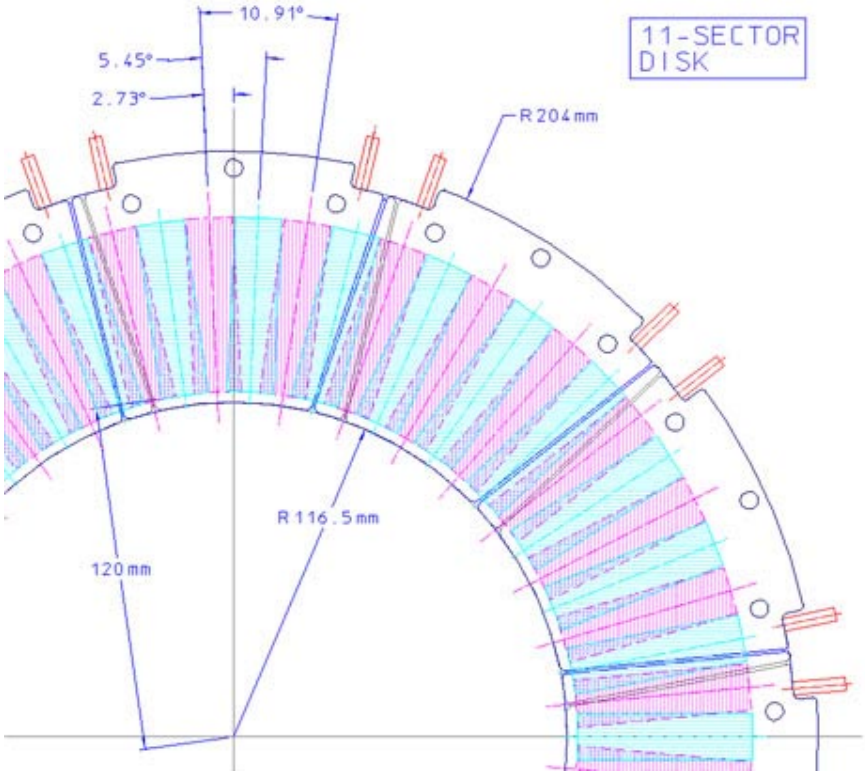
Disk	Nr. Mods.	R inner	R outer	Z position
1	66	120.0 mm	180.8 mm	465.0 mm
2	66	120.0 mm	180.8 mm	573.0 mm
3	66	120.0 mm	180.8 mm	631.0 mm
4	54	97.0 mm	157.8 mm	708.0 mm
5	54	97.0 mm	157.8 mm	770.0 mm

These layouts have acceptance gaps of approximately 0.4% and coverage to eta = +/- 2.51. These layouts allow an additional 6 mm more of radial clearance between disks and support frame for services than MCMD compatible layouts.

Note: A larger first disk using 72 modules will locate the first disk at approximately 480 mm. The 6 mm additional clearance of the 66 module disks will be lost.

Layouts of Disks compatible only with Flex module.





Summary of Sector Progress

ESLI sector:	Structurally acceptable with 0.43 mm faces to ? bar Thermal performance of sector 9 acceptable Quality control, dimensions? Probably radiation hard Reduction of radiation length from 0.58% ? Baseline choice
Al Tube sector:	Structurally acceptable with 0.30 mm faces to 3 bar Thermal performance good Quality control, dimensions good Survives 22.3 MRads Reduction of radiation length from 0.57% ? Aluminum-carbon corrosion ? Backup
C-C tube sectors:	Very stiff with 0.5 mm faces Thermal performance unknown at present Quality control, dimensions probably good Radiation hard ? Radiation length ? Testing of sealed tube ? Backup